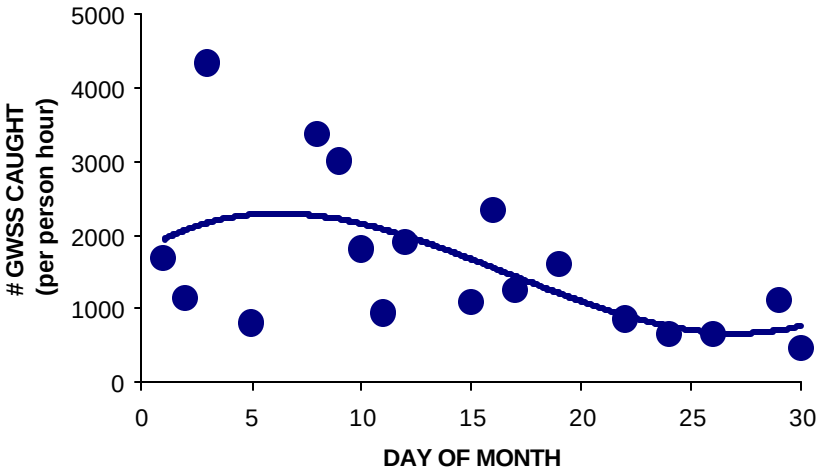
Biological Control of the Glassy-winged Sharpshooter

Monthly Report, July 2002

The new fiscal year heralded reorganization in the supervision of the Sharpshooter Biocontrol Project. As of July 1, 2002 the Biological Control Program (BCP) passed full responsibilities of the project to the Pierce's Disease Program (PDP). Since its inception, Charlie Pickett, Larry Bezark, and Nate Dechoretz have played major roles in locating, inspecting, and leasing the mass rearing facilities at Riverside and Bakersfield. They have also taken part in staff selection, training, outreach, and foreign exploration. We would like to take this opportunity to acknowledge the invaluable role that the BCP has played in the establishment of the biocontrol aspect of the PDP.

While formal responsibilities will no longer be held by the BCP, we anticipate a continuing close association between the programs as the GWSS biological control project develops.

GWSS ACTIVITY



The second generation of GWSS emerged as adults at the start of the past month, Consequently, we observed a sudden increase in adult GWSS populations followed by a gradual decline due to adult mortality (Figure 1).

Figure 1 (left): Collection of adult GWSS in Riverside / San Bernardino locations. July 2002.

Adults take a minimum of two weeks before the onset of the second ovipositional period of the year. We see this by the increasing proportion of "white spots" on the wings of GWSS females. Females place the spots on the wings shortly before they start oviposition (Figure 2). Older females do not necessarily produce white spots each time they produce eggs, so there is a corresponding decline in the proportion of white spots once females have started to oviposit.

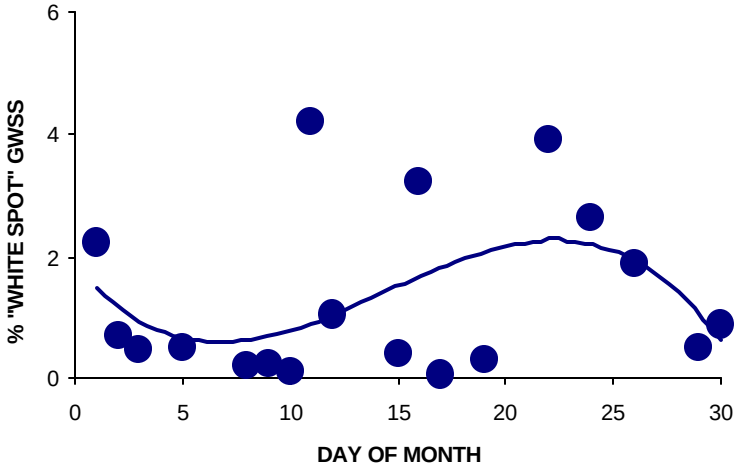


Figure 2: Proportion of adult GWSS with white spots in Riverside / San Bernardino locations. July 2002.

BIOLOGICAL CONTROL AGENT PRODUCTION AND RELEASE

The production and release of GWSS natural enemies has continued at reduced levels over the past month. The lower release rates were in response to reduced egg production in the rearing facilities and in the field as the second generation matured. The lull in production also gave staff time to carry out maintenance and construction at the rearing facilities.

Over 40,000 wasps were released in the month of July, 94% of which were the exotic species *Gonatocerus triguttatus.* The remaining wasps were exotic populations of species already found in California (Table 1). This brings the year's releases to *ten times* that in the same time period last year. At current rates, we hope to be able to produce more than 500,000 wasps this year.

Rearing Facility	Species released			TOTAL	County
	G. ashmeadi	*G. morrilli*	*G. triguttatus*		
Oswell Street	0	0	24165	**24165**	Kern
Oswell Street	0	0	1000	**1000**	Santa Clara
Mount Rubidoux	505	103	3266	**3874**	Los Angeles
Mount Rubidoux	140	0	1683	**1823**	Orange
Mount Rubidoux	456	0	2572	**3028**	Riverside
Mount Rubidoux	200	0	1895	**2095**	San Bernardino
Mount Rubidoux	657	210	3306	**4173**	San Diego
Total for July, 2002	**1958**	**313**	**37887**	**40158**	All Counties
Total for all of 2002	**27146**	**10873**	**160612**	**198631**	All Counties
Total since inception	**53946**	**11628**	**272177**	**337751**	All Counties

Table 1: Releases of GWSS egg parasitoids into California. July 2002.

BIOLOGICAL CONTROL AGENT MONITORING AND RECOVERY

Sites where repeated releases are being made are regularly inspected for parasitism rates (Figure 3). Egg masses are collected from each site and incubated. The proportion of eggs parasitized and composition of species parasitizing eggs are recorded and will be analyzed at the end of the season. At present, we have recovered *Gonatocerus triguttatus* from 8 locations. At four of these sites we have recovered the species more than once. We are awaiting the development of genetic techniques to discriminate between individuals originating from native and exotic populations of the same species, so do not know whether we have recovered offspring of the introduced *G. ashmeadi* and *G. morrilli* populations.

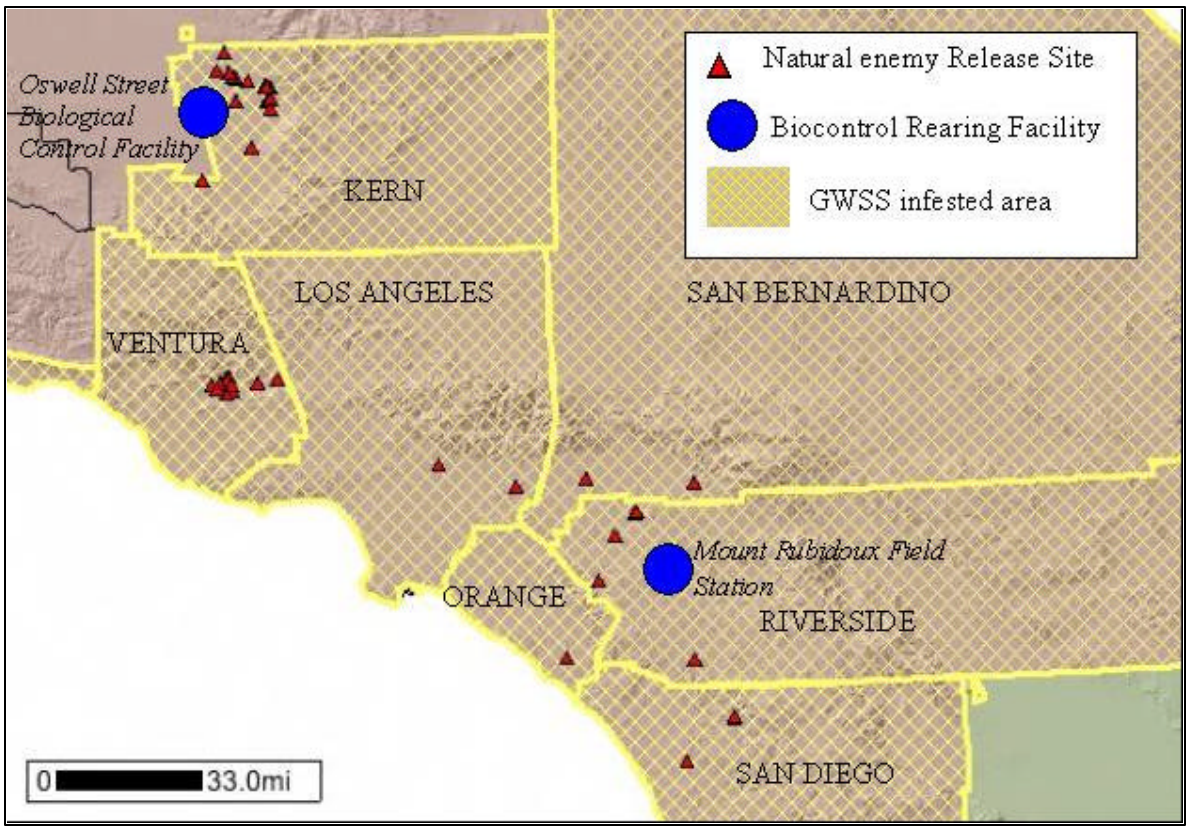


Figure 3: Release sites of GWSS egg parasitoids in California. July 2002.

Exact locations, release numbers at each location, dates of release and recoveries can be obtained by accessing the CDFA map server at http://max.cdfa.ca.gov/pdcp-gis/, selecting the "view maps" button, then clicking on "BioControl" from the scroll down menu under "select map set." The toolbar above the map can be used to zoom, identify and find out information from each release site. Rosie Yacoub at the CDFA-GIS section prepared this excellent database.

CURRENT EVENTS

On 12 July a permit was obtained for the release of *Gonatocerus fasciatus* (Figure 4). The insect is a minute version of *Gonatocerus ashmeadi* and has a number of attributes that make it a particularly exciting addition to the armory of GWSS natural enemies. The insect is a common parasitoid of GWSS in its native range, but only early in the year at low GWSS egg densities and before larger congeneric species.

The wasp's early season capabilities are, in part, due to two attributes: its ability to exist in cooler climates, and its gregarious nature. The wasp was found in Louisiana after a particularly cold snap. At the point of its recovery, few GWSS eggs and no other parasitoids were recovered. Upon examination, we found that between two and seven individual wasps emerge from *each egg*. That compares with one individual per egg for every other *Gonatocerus* species investigated. The consequence of having as much as 70 rather than 10 wasps emerging from a clutch of eggs is apparent. Other gregarious species of GWSS natural enemies have been identified (trichogrammatid wasps), but it has been impossible to rear them. A report of studies undertaken prior to permit application is available from dmorgan@cdfa.ca.gov

Figure 4: GWSS natural enemies. From left: *Gonatocerus ashmeadi, Pseneo punctatus,* and *Gonatocerus fasciatus*.

PREDATORS

In addition to parasitoid studies, we are making interesting headway in investigations of native predators as GWSS biological control agents. Three species being investigated currently are the specialist predacious wasp, *Pseneo punctatus* (figure 4), assassin bugs, and the commercially available lacewing.

OUTREACH

Outreach and education continue to be important aspects of the biological control project. We have been involved in PCA, master gardener, nursery inspector, and high school instruction. In addition to public outreach, we have also been participating in advisory task forces and academic arenas.

GWSS BIOLOGICAL CONTROL FACILITIES AND COOPERATORS

The **Mount Rubidoux Field Station** leasehold agreement has been signed. The Department of General Services has submitted the final estimate for renovation of the site but will be unable to proceed until the hiring freeze ends and the State budget is passed. Refurbishment will include upgrade of the HVAC systems in the greenhouses (7,000 square feet total) and upgrading to meet accessibility requirements.

The **CDFA Greenhouse at UCR** was completed in June and the lease signed soon thereafter. The structure is currently being fitted with irrigation systems, tables and lighting prior to being included for production. We anticipate half of the 2,000 square foot structure will be used for plant cultivation and the remainder as egging chambers.

The **CDFA Greenhouses at Biotactics**, Riverside are being used for hydroponic production of plant material for sharpshooter colonies. Currently we are investigating sorghum as a potential food source. This plant has the benefits of economy, ease of growth, trimming, and disposal. Studies by Dr. Simmons indicate its suitability as a host for GWSS.

The **CDFA-APHIS Oswell Street Biological Control Facility**, Bakersfield, is continuing to spearhead the efforts in California to initiate effective methods for maintaining large-scale sustainable colonies of GWSS independent of field populations. The development of such colonies is essential for all research involving GWSS as well as for providing eggs for parasitism out of season. Research into predators and parasitoid competition is also underway.

UCR Entomologists (Drs. Hoddle and Irvin) are continuing to investigate life history parameters of GWSS egg parasitoids, including windows of opportunity for egg parasitism, the importance of parasitoid diet provision, and interspecific competition between parasitoids.

UCR Quarantine (Dr. Triapitsyn) has played a key role in the screening and maintenance of potential GWSS natural enemies collected from out of state. *Gonatocerus fasciatus* quarantine, screening, and ultimate release were all carried out from the UCR Quarantine Facilities.

Buena Biosystems has been providing the CDFA with GWSS egg masses of consistently high quality. They are proving to be an invaluable source of GWSS eggs as they collect in and around the Fillmore area. GWSS in Ventura County have slightly different population dynamics than inland GWSS due to the maritime climate. Over the past month Buena has exceeded their monthly contractual obligations for egg supply by over 10,000. GWSS eggs are used primarily for parasitoid production.

USDA-APHIS, Mission has taken primary responsibility for maintaining master colonies of parasitoids. It is only through Dr. Lauziere's studies that we have been able to maintain continuous colonies. As a part of the studies into the potential of South American species of egg parasitoids as GWSS natural enemies, Dr. Lauziere is evaluating the parasitoids' host range on North American sharpshooters.

USDA-ARS, Weslaco is investigating genetic similarities of sharpshooters and their parasitoids collected from different geographic areas. Jesus de Leon has found

consistent differences between GWSS populations within California as well as between California and Texas. Dr. Walker Jones is also overseeing exploration for GWSS natural enemies in South America.

FURTHER COOPERATION AND ACKNOWLEDGEMENTS

As an integral part of the Biological Control Project, we have been assisting a number of colleagues in developing techniques for controlling GWSS. Some of the cooperative efforts are outlined below:

USDA-ARS, Weslaco:	Parasitoids and GWSS for genetic analysis.
USDA-ARS, Starkville:	GWSS for artificial diet development.
USDA-ARS, Ventura:	GWSS eggs for temperature-lethality studies.
USDA-ARS, Riverside:	Parasitoids for non-target effects.
ND State University:	GWSS for histological studies.
USDA-APHIS, Mission:	Parasitoids for initiation of master colonies.
UC-Riverside:	Parasitoids for competition studies.

Without the unstinting support of many collaborators from the federal, state, academic, and industry arenas, this work would be impossible. In particular we would like to thank Dr. Purcell (UC Berkeley) for providing us with native Cicadellidae for host range screening of *Gonatocerus fasciatus*. We also wish to thank Don Dillon, Jr. from the Four Winds Nursery and Leon Ruiz from Thermal Nursery for the donation of citrus trees for GWSS colonies.